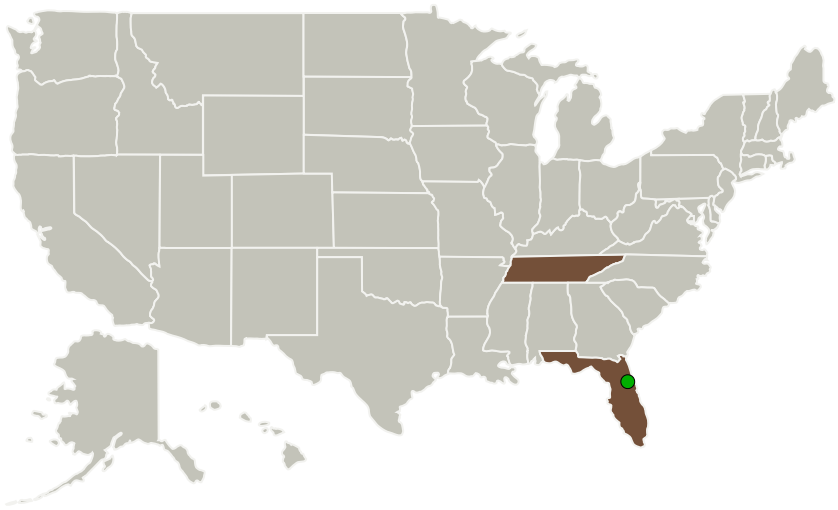
High Reliability Cryogenic Piezoelectric Valve Actuator, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

Piezoelectric actuators constructed with the "smart material" PZT offer many potential advantages for use in NASA cryo-valve missions relative to conventional electromagnetic-driven mechanical actuators. In addition to their very high resolution (a benefit to nanopositioning applications for many years), they offer potential advantages for miniaturization and reduction of heat load as compared to electromagnetic actuators. While some notable successes have been achieved in adapting piezoelectric actuators to cryogenic applications, the technology needs further innovation, development, and validation in order to reach a readiness level that can realistically be considered for use in future missions. Variation in strain rate with temperature, CTE mismatch relative to structural materials, and problems with protective coatings make use of PZT in cryogenic environment difficult. Thorough characterization of existing PZT material and proposed improvements to coatings and structural materials used with PZT transducers offer the potential for higher performance and reliability. With these improvements, it will be practical to use piezoelectric actuators in applications such as high force cryo-valves that can not presently be considered.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Dynamic Structures and Materials, LLC	Lead Organization	Industry	Franklin, Tennessee
Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations	
Florida	Tennessee

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140120)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Dynamic Structures and Materials, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Jeffrey S Paine

Co-Investigator:

Jeffrey Paine

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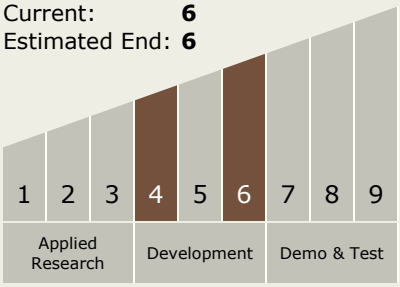
Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.1 Integrated Systems and Ancillary Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System